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Integrated valve cylinder.

Abstract:

The disclosure relates to an integrated cylinder valve intended for use primarily in gas therapy and to be permanently connected to a gas cylinder and surrounded by a protective cup (10) fixedly mounted to the cylinder, the valve comprising a valve housing with connection socket (6) for the gas cylinder, there being disposed, in the socket, a residual gas valve for preventing gas below a certain pressure from departing from the cylinder, and a non-return valve for preventing gas from passing into the cylinder. The integrated cylinder valve further includes a regulator (1) disposed in the valve housing and operative to reduce the cylinder pressure to suitable working pressure, a shut-off valve (3) for the gas, a quick coupling device (5) for connection of a consumption conduit, and a device (7) for con

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nection of a gas replenishment conduit to the cylinder, and a device (4) for indicating the gas content in the cylinder. The outlet of the regulator is directly connected to the shut-off valve (3) and is provided with means, disposed between the diaphragm (f) and regulator cone (e) designed to reduce the increase in the secondary pressure on reduction of the primary pressure of the regulator. The diaphragm (f) of the regulator is provided, in its central region, with a safety valve (a, b) operative to open at a predetermined level of the secondary pressure. The shut-off valve (3) connected to the outlet of the regulator is arranged to assume a distinct open and closed position and to be held in each respective end position by the secondary pressure of the regulator, the valve position (i) being actuable by means of a reciprocal device.

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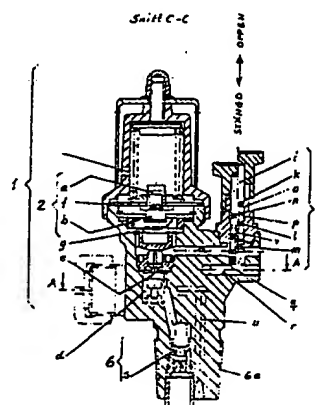
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**(84) Integrated valve cylinder.**

(57) The disclosure relates to an integrated cylinder valve intended for use primarily in gas therapy and to be permanently connected to a gas cylinder and surrounded by a protective cup (10) fixedly mounted to the cylinder, the valve comprising a valve housing with connection socket (6) for the gas cylinder, there being disposed, in the socket, a residual gas valve for preventing gas below a certain pressure from departing from the cylinder, and a non-return valve for preventing gas from passing into the cylinder. The integrated cylinder valve further includes a regulator (1) disposed in the valve housing and operative to reduce the cylinder pressure to suitable working pressure, a shut-off valve (3) for the gas, a quick coupling device (5) for connection of a consumption conduit, and a device (7) for connection of a gas replenishment conduit to the cylinder, and a device (4) for indicating the gas content in the cylinder. The outlet of the regulator is directly connected to the shut-off valve (3) and is provided with means, disposed between the diaphragm (f) and regulator cone (e) designed to reduce the increase in the secondary pressure on reduction of the primary pressure of the regulator. The diaphragm (f) of the regulator is provided, in its central region, with a safety valve (a, b) operative to open at a predetermined level of the secondary pressure. The shut-off valve (3) connected to the outlet of the regulator is arranged to assume a distinct open and closed

position and to be held in each respective end piston by the secondary pressure of the regulator, the valve position (l) being actuable by means of a reciprocal device.



*Fig 6*

## Description

## INTEGRATED CYLINDER VALVE

## TECHNICAL FIELD

The present invention relates to an integrated valve apparatus intended for use primarily in gas therapy and to be permanently connected to a gas cylinder and surrounded by a protective cup fixedly mounted on the cylinder, the valve apparatus essentially comprising a valve housing with a connection socket for threading into the gas cylinder, there being provided in the socket a residual gas valve for preventing gas below a certain pressure from leaving the cylinder, and a non-return valve for preventing gas from passing into the cylinder, and a regulator which is disposed in the valve housing and is operative to reduce the cylinder pressure to a suitable working pressure, a safety valve intended to open at a certain level of the secondary pressure of the regulator, a shut-off valve for the gas, a quick-coupling device for connection of a consumer conduit and a device for connecting a conduit for replenishment of gas in the cylinder, and a device for indicating the gas volume in the cylinder.

## BACKGROUND ART

In, for instance, medical care both in hospitals and in the home, use is widely made of so-called gas therapy, for example oxygen therapy, which implies that gas is administered to a patient by the intermediary of a conduit from a gas cylinder. The conduit from the patient is connected to a gas regulator which, in turn, is connected to a cylinder valve screwed into the gas cylinder. When the gas flow is to be shut off or turned on, respectively, this is effected by turning the knob on the cylinder valve. In such instance, many patients have difficulty in producing the force necessary to turn the knob. It may also be difficult to adjust the regulator so as to obtain the correct gas pressure. When a gas cylinder is replaced, the regulator must be unscrewed from the cylinder valve, this requiring a special tool. In addition, absolute cleanliness from fat and oil is positively required when handling oxygen. This places severe demands on the person who is to operate the equipment. As a result, problems may arise both at hospitals and in the home. In particular in the home, such problems may reach alarming proportions, since the users are either ill or handicapped.

## OBJECT OF THE INVENTION

The object of the present invention is, therefore, to devise such equipment in which the above-mentioned drawbacks will be obviated. In this context, the apparatus essentially comprises a valve housing which integrally contains a regulator, shut-off valve, quick coupling device with non-return valve, pressure indicator, connection for replenishment conduit and residual gas valve, and a non-return valve indicating a connection socket to the gas cylinder, this apparatus being substantially characterized in that the outlet of the regulator is directly connected

to the shut-off valve; that the regulator is provided with means disposed between the regulator diaphragm and regulator cone and being operative to reduce the increase in the secondary pressure on reduction of the primary pressure of the regulator; and that the diaphragm of the regulator is provided, in its central region, with a safety valve operative to open at a predetermined level of the secondary pressure of the regulator; and that the shut-off valve connected to the outlet of the regulator is disposed to assume a distinct open and closed position and to be held in each respective end position by the secondary pressure of the regulator, the valve piston being actuable by means of a reciprocating device.

## BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The nature of the present invention and its aspects will be more readily understood from the following brief description of the accompanying Drawings, and discussion relating thereto.

In the accompanying drawings:

Figs. 1, 2 and 3 show the valve apparatus seen from different directions;

Fig. 4 is a top plan view of the apparatus;

Fig. 5 shows the apparatus fixedly mounted on a gas cylinder and provided with a protective cup;

Fig. 6 is a section through the regulator unit, shut-off valve and residual gas valve;

Fig. 7 is a section through the quick-coupling device and replenishment connection; and

Fig. 8 shows a pressure indicator.

## DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the Drawings, the valve housing is of one-piece pressed manufacture which has been machined to accept placement of the units included in the integral valve apparatus. Figs. 1-4 show the valve apparatus seen from different directions. The apparatus includes a regulator device 1 with safety valve 2, a shut-off valve 3 which is connected to the regulator and to a quick-coupling socket 5 for connection of a consumer conduit. The apparatus is further provided with a residual gas valve with a non-return valve 6 built into a connection socket 6a for connection to a gas cylinder, and a replenishment socket 7 for connection to a replenishment conduit. The apparatus further includes a pressure indicator 4.

Fig. 5 illustrates the integral valve apparatus mounted on a gas cylinder 14. The apparatus is intended for permanent fixation on the cylinder. A protective cup 10 is also fixedly mounted on the cylinder and surrounds the valve apparatus. The cup is open at the top, and a part 12 of its circumferential surface has also been removed to allow for good accessibility on operation of the valve apparatus. There are also disposed, in the wall of the cup, a recess 11 for connection of the replenishment conduit, and a recess 13 which serves as a grip when

the unit, consisting of cylinder, valve apparatus and cup, is moved.

The valve housing includes a threaded connection socket 6a which is intended to be permanently screwed into the gas cylinder. In the connection socket, there are provided a gas replenishment channel u, and an evacuation channel. The replenishment channel is in communication, by the intermediary of a non-return valve device t, with a connection for a replenishment conduit. The non-return valve prevents the gas from flowing out once the cylinder has been filled and the replenishment conduit has been removed.

In the evacuation channel, there is provided a so-called residual gas valve 6 which is operative to prevent the gas cylinder from being completely emptied of its contents. The valve only allows passage of gas above a predetermined pressure. The residual gas valve is also provided with a non-return valve device s which prevents gas from flowing into the cylinder through a connected regulator. This provision absolutely excludes the possibility that impurities may enter the cylinder once its gas contents have been consumed. As a result, the user will be guaranteed gas of the highest quality. Furthermore, replenishment of gas may be affected without the need of first vacuum-pumping the cylinder and flushing it with pure gas.

The evacuation channel discharges in the inlet to a gas pressure regulator 1 whose purpose is, hence, to reduce the cylinder pressure to a suitable working pressure. A device which reduces the dependency of the secondary pressure upon the primary pressure on falling primary pressure is inserted in the regulator.

A safety valve 2 is built into the regulator 1 and is operative to open at a predetermined secondary pressure; the working pressure in the regulator. In the centre of the regulator diaphragm, there is disposed a fistular member a in which is inserted a diaphragm seat b. This is disposed in the drilled plate g. In normal operation, these parts are urged against one another, i.e. by the force from the regulator spring c in one direction and, in the other direction, by the force from the sealing spring d and by the secondary gas pressure multiplied by the surface area at the diaphragm centre. In the event of, for example, leakage in the valve seat e of the regulator, the secondary pressure will rise and, as a result, the diaphragm f will be influenced such that it moves towards the regulator spring c. However, the diaphragm seat is prevented from being entrained in this diaphragm movement by plate g. In this instance, the fistular member a departs from the seat b at a certain level of the secondary pressure, whereby the gas may pass into the regulator cup and through the cup out into the atmosphere, thereby preventing further increase of the secondary pressure.

The outlet of the regulator is in communication, through a channel q, with a shut-off valve 3 which has two distinct positions - open and closed. The outlet of the valve is connected to a quick coupling device 5, to which a conduit to a consumption apparatus may be connected without the use of

tools. Two non-return valves are integrated in the apparatus, one which shuts off the gas flow if the equipment is disconnected and the shut-off valve is in the open position, and one which prevents any possible flow back into the regulator and, at the same time, makes for closure of the shut-off valve at the connected consumption apparatus. Thus, the quick coupling device comprises a female section to which a male section disposed at the consumption conduit may be connected. This coupling is indexed, which implies that only equipment suited to the purpose in question may be connected. As a result, it will always be guaranteed that the correct gas is supplied to the user's equipment. The shut-off valve 3 which, thus, cooperates with the quick coupling device 5 functions, therefore, independently of external circumstance, i.e. if the consumption conduit is connected or not, and if the conduit is connected whether the consumption apparatus is in use or not. The valve is operated by means of a handle which is fixedly retained on a piston l, on which are disposed sealing rings k, l and m. In the piston, there is also provided an air bleeder channel which comprises a central channel v discharging into radial channels n. The piston is displaceably disposed in the nipple o which is screwed into the valve housing. A groove p is provided in the nipple. When the valve is in the open position (the right-hand position in Fig. 6) the sealing rings k and l seal against the nipple o. The piston is held in this open position by the secondary pressure in the channel q from the regulator and the sealing ring k. Gas may now flow from the channel q past the piston to the channel r and through the quick coupling device 5 to the consumption conduit. When the valve is in the closed position (the left-hand position in Fig. 6) the sealing ring m seals against the seat so that gas is prevented from flowing from channel q to channel r. The gas which is in the channel r between the valve 3 and the quick coupling device 5 will then pass, via the apertures v and n and the groove p through the space between piston and nipple and beneath the pull-button out into the atmosphere, the channel r being bled. The valve position will hereby be held in the closed position by the gas pressure on the secondary side of the regulator. The pressure then acts on the surface defined by the sealing m. On closure of the valve, the sealing k is released by the groove p in the nipple.

A pressure indicator 4 is also connected to the replenishment channel u, the indicator showing the primary pressure in the gas cylinder. This pressure indication is a measure of the remaining gas content in the cylinder.

The integrated valve apparatus described in the foregoing has made it possible, for example when the gas supply has been consumed, to replace the cylinder together with integrated valve in that the patient conduit is disconnected from the quick coupling device and inserted in a corresponding quick coupling device mounted on a full cylinder. Such an operation may be effected extremely rapidly and without the need of any tools. Furthermore, the gas flow may be shut off or opened with a minimum use of force. It is easy to ascertain the remaining gas

volume in the gas cylinder. Moreover, complete emptying of the gas supply in the cylinder is prevented, with the result that the cylinder is not open to contamination once the consumer conduit has been disconnected. The provision of a protective cup surrounding the valve apparatus affords excellent protection of the valve apparatus from damage if the cylinder were unintentionally to be knocked over. The cup also forms a grip, which makes it easy to transport both cylinder and valve apparatus. Thus, the apparatus according to the present invention as described herein has considerably facilitated gas therapy both for medical care staff and for patients.

The present invention should not be considered as restricted to that described above and shown on the Drawings, many modifications being conceivable without departing from the spirit and scope of the appended Claims.

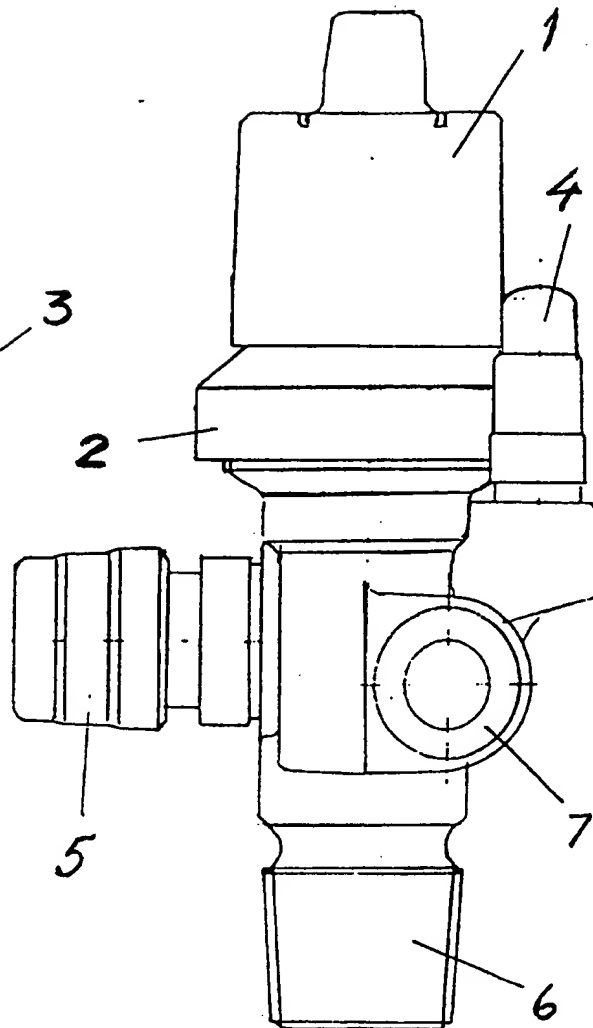
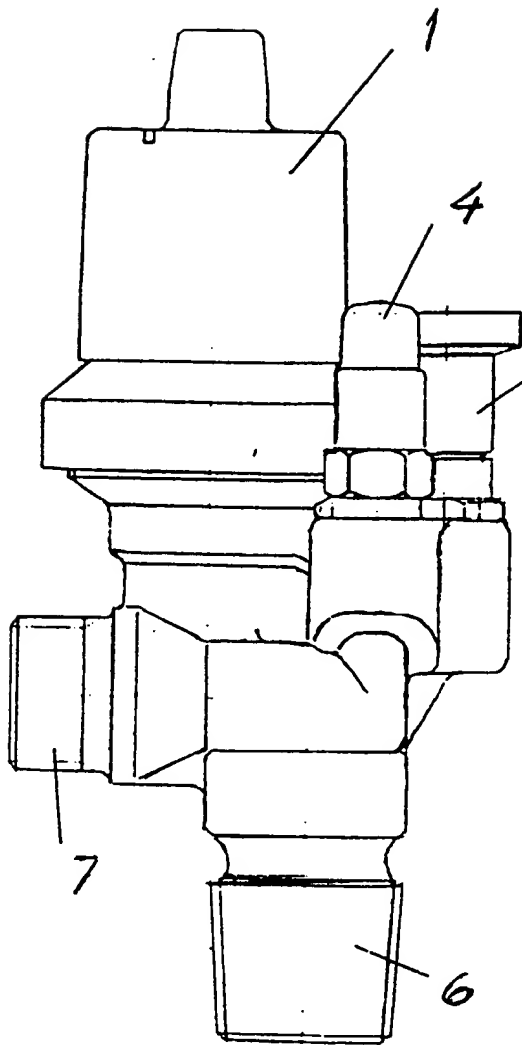
#### Claims

1. An integrated cylinder valve intended for use primarily in gas therapy and to be permanently connected to a gas cylinder and surrounded by a protective cup (10) fixedly mounted to the cylinder, the valve comprising a valve housing with connection socket (6) for the gas cylinder, there being provided, in the socket, a residual gas valve for preventing gas below a certain pressure from departing from the cylinder, and a non-return valve for preventing the gas from passing into the cylinder, and a regulator (1) disposed in the valve housing and operative to reduce the cylinder pressure to suitable working pressure, a safety valve disposed in the valve housing and intended to open at a predetermined level of the secondary pressure of the regulator, a gas shut-off valve (3) disposed in the valve housing, and a device (4) disposed in the valve housing for indicating the gas content in the cylinder, and a quick coupling device (5) for connection of a consumer conduit and a device (7) for connection of a gas replenishment conduit to the cylinder, characterized in that the outlet of the regulator is directly connected to the shut-off valve (3); that the regulator is provided with means, disposed between the diaphragm (f) and regulator cone (e), designed for reducing the increase in the secondary pressure on reduction of the primary pressure of the regulator; and that the diaphragm of the regulator is provided, in its central region, with a safety valve (a, b) operative to open at a predetermined level of the secondary pressure; and that the shut-off valve (3) connected to the outlet of the regulator is disposed to assume a distinct open and closed position and to be held in each respective end position by the secondary pressure of the regulator, the valve piston (i) of the shut-off valve being manually operable by a reciprocal device.

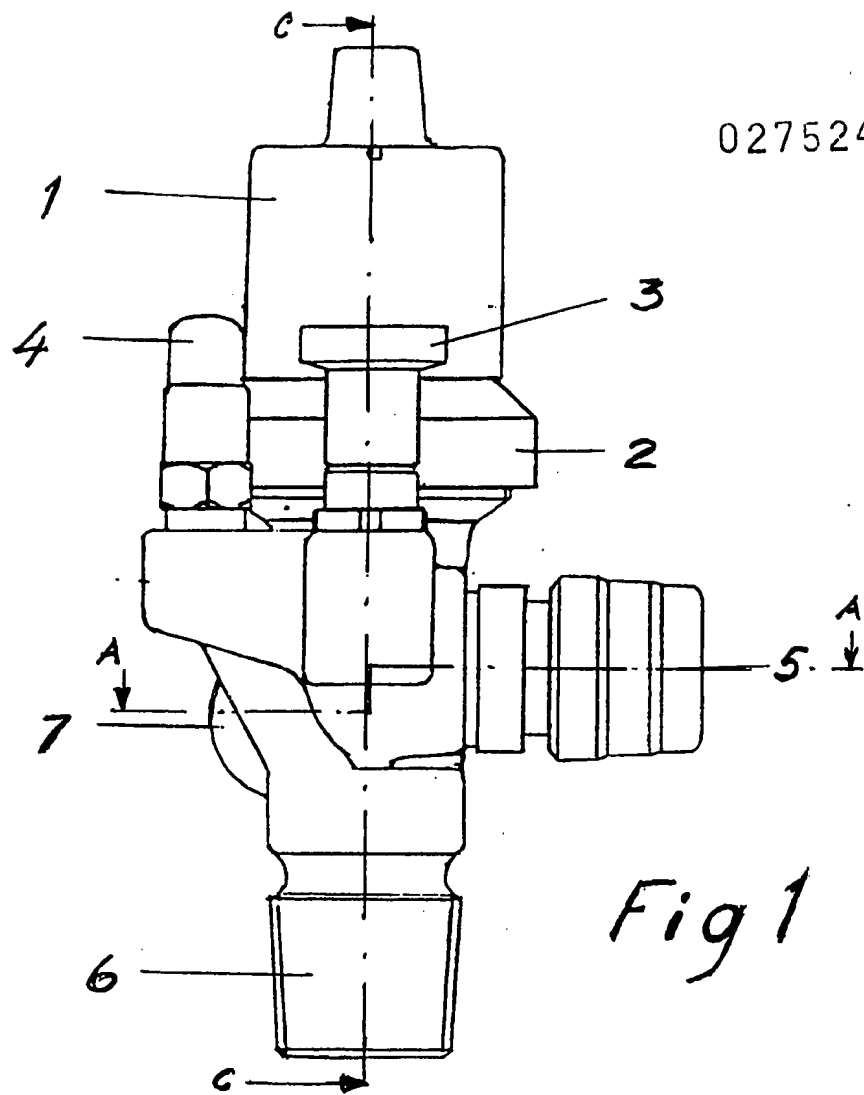
2. The integrated cylinder valve as claimed in Claim 1, characterized in that said safety valve (a, b) includes a fistular member (b) disposed in the centre of the diaphragm and arranged to cooperate with a device (b) fixedly disposed in the centre of the regulator chamber, said devices being separated, at a secondary pressure in excess of a predetermined level, in that the diaphragm raises the fistular member (a) from the fixed device (b), such that gas may pass out into the atmosphere.

3. The integrated cylinder valve as claimed in Claim 1, characterized in that there is disposed, in said piston in the shut-off valve, a central channel (v) and a transverse channel (n) in communication therewith, said channels being arranged to cooperate with grooves (p) in the valve cylinder so that, on closure of the valve, gas entrapped in the channel (r) between the quick coupling device (5) and the shut-off valve (3) is allowed to pass out into the atmosphere.

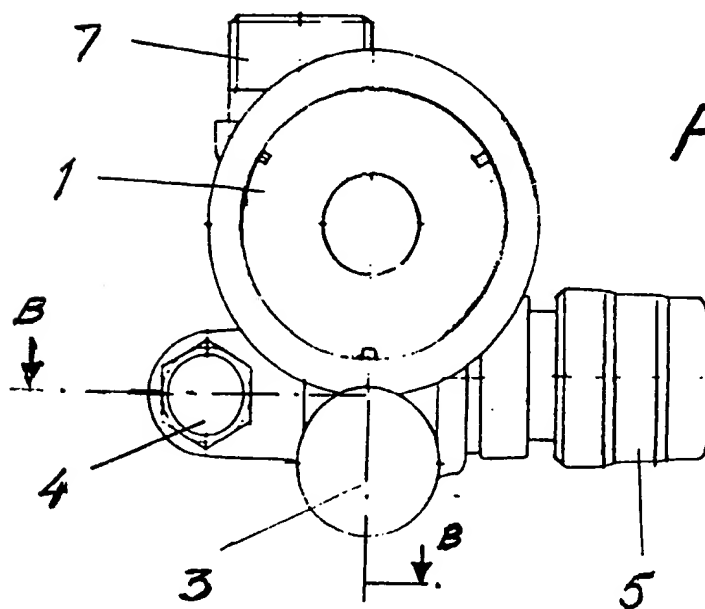
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*Fig 1*



*Fig 4*

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1

2

3

4

5

7

10

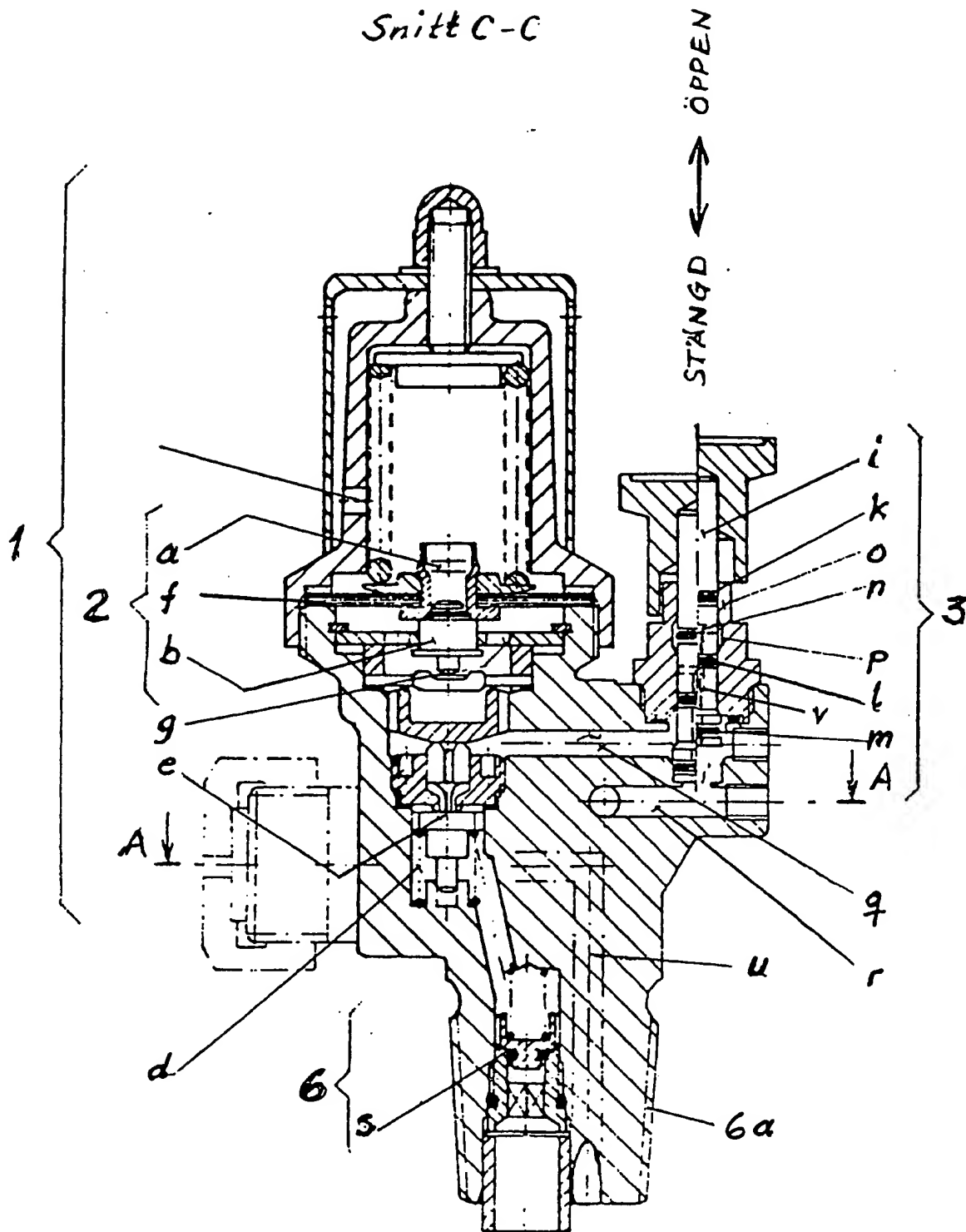
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*Fig 5*



Snitt A-A



Snitt B-B

Fig 8

